



#### **ATMOSPHERIC INFRARED SOUNDER**

**PROJECT STATUS** 

**September 30, 2003** 

Presented by T. Pagano
California Institute of Technology
Jet Propulsion Laboratory



## **AIRS/AMSU/HSB Objectives**



- Demonstrate Technology
- Demonstrate Basic Algorithms (L0, L1, L2)
- Provide Data Products to Weather Centers
  - Near Real-Time Distribution for assimilation into forecast models
- Answer Key Science Questions
  - The global water and energy cycle: Is the cycle of evaporation and precipitation on Earth accelerating?
  - Determine the distribution and variations of water vapor
     Earth's primary greenhouse gas
  - Climate weather connection: Are current weather anomalies (hurricanes, droughts) connected to climate change and how?
  - Trace Gasses: Will develop global map of the distribution of atmospheric concentration of CO2



## AIRS/AMSU/HSB DATA PRODUCTS



Radiance Products (Level 1B)	RMS Uncertainty*	<b>Horizontal Resolution</b>	
AIRS IR Radiance	3%	15 x 15 km	
AIRS VIS/NIR Radiance	20%	2.3 x 2.3 km	
AMSU Radiance	0.25-1.2 K	45 x 45 km	
HSB Radiance	1.0-1.2 K	15 x 15 km	
Standard Core Products (Level 2	<u>2)</u>		
Cloud Cleared IR Radiance	1.0K	45 x 45 km	Vertical
Sea Surface Temperature	0.5K	45 x 45 km	Resolution
Land Surface Temperature	1.0K	45 x 45 km	km below 700 mb
Temperature Profile	1K	45 x 45 km 2	2 km 700-30 mb
Humidity Profile	15%	<b>45 x 45 km</b> — 2	km in troposphere
Total Precipitable Water	5%	45 x 45 km	
Fractional Cloud Cover	5%	45 x 45 km	
Cloud Top Height	0.5 km	45 x 45 km	
Cloud Top Temperature	1.0 K	45 x 45 km	



## **AIRS Team Accomplishments**



- Congratulations! All first year milestones satisfied
  - Activation and Evaluation of AIRS/AMSU/HSB
  - Delivery of Level 1B to NOAA and the GSFC DAAC
  - NOAA delivers AIRS Data to the International Weather Centers
  - Level 2 Meets 1K/km Temperature Requirements
  - Level 2 Delivered to the GSFC GMAO (Assimilation Office) for impact assessment
  - Level 2 Delivered to the GSFC DAAC
  - User Guide and Validation Report Delivered
  - Level 2 Available to the Public at the GSFC DAAC
  - Level 2 Available to NOAA. Distribution to NWP centers shortly
- Next: Exploration. New Territory.



# JPL DEVELOPS "FOCUS GROUPS" TO FACILITATE PROJECT PRIORITIES



•	Instrument Operations and Calibration	D. Elliot
•	<b>Level 2 Product Maintenance and Upgrade</b>	S.Y. Lee
•	Level 3 Product Development	S. Granger
•	Product Validation	E. Fetzer
•	Software Development, Computing and Archive Friedman	S.
•	Science and Climate Research	B. Lambrigtsen
•	User Services	E. Olsen
•	Education and Public Outreach	S. Okonek
•	<b>Project Priorities Defined for Each Focus G</b>	roup



#### **Instrument Operations and Calibration**



- Continue Operations, Extend Mission Life
  - Routine Operations, Telemetery Trending
  - Early Anomaly Detection
  - Spacecraft Designed for 6 years, Expect 7-9
  - AIRS Design Life is 5 years, Expect 7
  - AMSU Design Life is 3 years, Longest is 5.5y and going
- Improve accuracy of raw sensor radiances
  - As level 2 products mature more emphasis will be on improving level 1 products accuracy
  - Spatial effects may become more important, particularly over land
  - Noise effects (striping, correlated noise, etc.) may limit ultimate sensitivity of retrievals



## **Level 2 Product Maintenance and Upgrade**



- Satisfy Weather Forecast Prediction Centers (Short Term)
  - Infrequent errant data points (outliers) significantly mitigate forecast improvement
  - Investigate ways to identify outliers using internal indicators
- Make AIRS Data More Accurate (Longer Term)
  - Improve water vapor spectroscopy
  - Improve boundary layer accuracy
  - Improve surface accuracy (emissivity and temperature)
  - Improve cloud clearing
  - Address ocean first, then land



### **Level 3 Product Development**



#### Make AIRS Data Easier to Use

### **Near Term**

- Develop standard TOVS based gridded data sets
- Clear-only footprint subsetting
- Work with scientists to define requirements for more advanced needs

### **Longer Term**

- Principal Component Files
- Statistics Files



# **AIRS VALIDATION TIMELINE Next up: Nonpolar night land**



Validate AIRS Data Products

	Version	3.0	4.0	5.0	6.0	7.0	8.0
	Activation Date	<del>-7/1/08-</del>	9/17/04	6/24/05	3/24/06	12/15/06	9/21/07
Radiance Products (L1)		8/15/03					
	AIRS Radiance	Prov	Val2	Val4	Val5		
	VIS/NIR Radiance	Prov	Val2	Val4	Val5		
	AMSU Radiance	Beta	Prov	Val2	Val4	Val5	
	HSB Radiance	Beta	Prov	Val2	Val4	Val5	
Standard Products(L2)							
	CloudCleared IR Radiance	Beta	Val2	Val3	Val4	Val5	
	Surface Temperature	Beta	Val2	Val3	Val4	Val6	
	Temperature Profile	<del>Beta</del> Prov	Val2	Val3	Va4	Val5	
	Humidity Products	Beta	Val1	Val 2	Val3	Val4	Val5
	Cloud Cover Products	N	Beta	Val1	Val2	Val2	Val3

Beta = Not suitable for scientific investigations.
Consult with AIRS Project on regional status.

Prov = Provisionally validated. Useable for scientific investigations with caution. Validated for nonpolar night ocean only Val1 = nonpolar day/night ocean.

Val2 = Val1 + nonpolar night land.

Val3 = Val2 + nonpolar day land

Val4 = Val3 + polar night

Val 5= Val 4 + polar day.

**Validation Report Accompanies Every Delivery** 



## **Software Development, Computing and Archive**



#### Deliver our Standard Data Products

- NOAA: Planned interim delivery in TBD '04.
- L2 Direct Broadcast Expected in TBD '04
- Meet next major PGE delivery in 9/04
- Provide Computing Resources
  - Unified Team Algorithm Software Integration
  - Testing, Archiving, Routine Processing Operations, Matchup

### Develop User Friendly Tools

 Work with L2 and L3 teams to develop tools to make our products easier to use



#### **Science and Climate Research**



- Create Stable Climate Data Records
  - Draw upon internal expertise to address climate questions and create products
  - Help define the data products needed to facilitate studies of climate research by the community
- Identify Applications for AIRS Data
  - What weather questions can be answered
  - What visualizations are required
- Participate in Interdisciplinary Science
  - AIRS data useful for hydrological cycle, energy cycle, and carbon cycle
  - Coordinate with other instrument science teams
    - Multi-Sensor Products, Validation



#### **User Services**



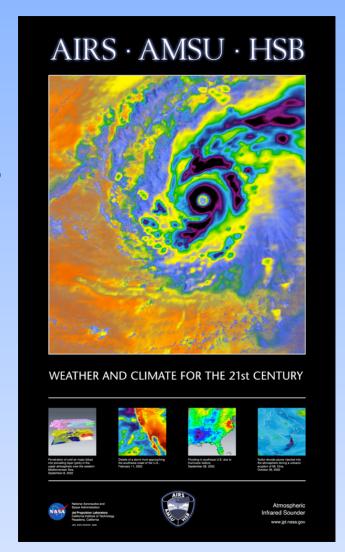
- Make AIRS Data more accessible
  - Science Team Support
    - Focus Day Processing
    - Special Processing and Data Requests
  - External Science Team Requirements
    - Readers
    - Documentation (User Guide)
  - To the pubic
    - Hurricane Visualizations
  - Solicit Feedback from Users
    - Web Surveys, Web FAQ
  - Participate In/ Host User Workshops



#### **Education and Public Outreach**



- Engage the Public/Education
  - To inspire future generations…
  - NASA Vision
  - Good press for the project helps NASA get support for the current activities and future efforts
  - Support our Schools
  - Participate in Conferences
  - Support media
  - Press Releases
  - Poster
  - T-Shirts





#### FY'04 Release Characterization



- V3.5 Internal Quality Indicators
  - Improved AIRS Project derived Level 2 quality indicators to support data assimilators
- V3.7 Benchmark Assessment of V4.0
  - Preliminary first release software (e.g., Level 3)
  - Any software that will affect down-stream Level 1 or 2 processes
  - Any code that is ready to go
- V4.0 Next Public Release
  - Improved Level 2 products
  - Validation region extended latitudinally, over land
  - First release of any Level 3 products



## **FY'04 Schedule Highlights**



	Release Emphasis	Prototyping Ends	Development Ends	System Stabilized	Version Complete
V3.5	Internal Quality Indicators	01/06/04	02/02/04	02/18/04	03/12/04
V3.7	V4.0 Benchmark	03/01/04	03/29/04	04/13/04	05/04/02
V4.0	Public Release	05/28/04	07/02/04	08/03/04	08/31/03



## **V3.5 Release**



_				Air 1.	-				972		_			184		N.	
D	Test Resea		Pirish.	<b>**</b> **********************************		New	Т	Des.		4	No	Т		+*	-	Ĭ,	
1	Project Milestone	Man 41 AX	Mars 447 RG											T			
3	Af Billiotic	Tee 27004	Te-47454	1 1									0.5	Ú	ı M	М.	
3	ſ	Men 47.52	No.446	ı										i			
4	ISJ-ISJA hally fators	Tel 9860	Tex-0/054		-				÷					÷			
7	Printiging and Commission	Year Heater	Mar 1 681		000		*****		_		•						
•	First implicate CCS	Tue 1980	Ten 1.004	1 1					718	ı							
•	Consistent and Link Test	Tue Little	Nam 3370							****	•						
18	hille bahi and dalony to TDB	Tur 2000	Tue 2004	1 1						F,	•			i			
11	Curtified Amounty Guidric	Wed 24604	Yhd 2700	li						þ		и.	•	i			
12	TO-FIRST	West 2/5/04	T(m) 2(1) (0)	ł						•	·			i			
13	Till mile mi desiral	Tres 270204	77ml 3/100	1 1		<b>V</b> 3	_				35.						
14	Operational in TCSS	West 24 504	THE YEAR	1 1		٧J	.၁					M		i			
15	Besiden Tedling	The 271904	THE STORE	ı	I	nter	rna	1						ı			
19	Miri Villelika	The STOOL	Time Street	li				-					or .				
17	Prouity Review properation	The SHEET	Fri 3/1284	1 1		Qua	•	•					K				
19	Prodrip Review	PHARAGE	PH 3/12/94		In	dica	ato	rs					7	œ			
18	Parkaging and Shipping	Man 24 5.04	In Mile	li									6				
-	Callery in MEAA	Tue MARKET	Time SALMON	ł								27	• <del>1</del> 1	÷	-+1		_
21	JT. Bayesi to HEAA	146436784	Tem 41304	1 1									****	<u></u>	**		



## **V4.0 Release Track**



	I	Т	Obr 1, 200	μ	Q#-2, 2004		OF 3, 2004	44.20	Ot 1, 2005
	Themis Marine		Flesials	Mary Date	Jan Rab	No.	1/2 Ref. 1/2	Jai Jaay Sep	Oal Nev
•	V37 - (42 Tarchert)	A64 40 20 52	Jan Delit				_		
7	Fridaysing and Characterists	Time 1025003	Mars 20 104			W.		1	
	Pholippinis 008	Tue 362-04	Tax 2004	ı		<b>₹3</b> 44		V3.7	
7	Development and Unit Test	Tue 3/2/04	Man 32004			200000000		V 3.7	
1■	initial habi and debaryts TCS	Texas 2000	Tue 2/3004			Г	154		
-11	Controlled Anomaly Guilds:	Wed 151.54	Tue 45 804			Þ	471	a benchmark	
12	TDS MAT	Wed SITEM	Tue 4804			4	<b>2</b> 1	assessment	
13	TDS and in and attacked	TV=148.DH	Tue 40 304				E .	of 1/4 0	
74	Operational in TDS	Tee 4/12/04	Tue 41 104				∰ens	of V4.0	
15	Rushshed Teeling	Wed-4749H	Tue 69404						
18	MH V-11-11-	Westfield	Tue EMD4				illiania.		
47	V3J Sendment Assessment	Tue 294.04	Tax 29604				7		
18									
18	Wid-Natio Rationary	W-127/84	T			•		<del>:                                    </del>	
3	Prototyping and Characterisation	Wed 351.54	PH-526204						
21	First Implicite CCS	Tue MAGA	Tue 87.04				Tan		
29	Development and Unit Text	Wedatabl	M 7504				·······		
25	Initial build and delivery to 175	Tue 779/04	Tue 776/04					<b>14</b> 14	
24	Controlled Amenally Qualities	TV-178.04	Tue CENCA					<u> </u>	
2	TOS.SAT	Wed 7/7/84	Tue 7/1 8/04					••••	
28	TDS end to end chestest	Wed7/1484	Tue 7/2004					<u> </u>	
27	Operational in TOTA	T == 7/20004	Tue 7/2004					<b>₽</b> 720	
3	Statished Testing	West 721.04	Tue 61704		:				
77	Visidation Date Proceedings	Wed 7/21/04	Tue 647/04		V4.0				
	Preside Review proposalism	West STEEM	Tue BOAD4					<u> </u>	
Ħ	Fresh Reduc	Ten 634.64	Tue 63604	0	ur next			<del>/7</del> 164	
<b>72</b>	Pedaging and Wilsyling	Www.8/25/84	Tue 601/01			_		<u></u>	
#	Delivery in DARC	T 881/04	Tur BON AM	Publi	ic Releas	e			
34	JPL Support to DARD	Wednesd	West March						
25	DACM	TV-181.04	West DETROIT					·	
*	Videbin Report Due	The 6250H	The 920004					<b>*</b>	<b>1</b> 22
37	Fubility Order Releases L2	Thu \$20004	The \$200M					107	Public Reterro



#### **SUMMARY AND CONCLUSIONS**



- It was an excellent first year! All 1<sup>st</sup> year milestones achieved.
- AIRS Priorities Identified for the coming year
- Priorities define our objectives and create a roadmap for the coming year's tasks
- Focus Groups help coordinate tasks to meet project priorities and objectives
- JPL to work closely with Science Team to Meet Objectives
- Delivery timeline established for NOAA and Public Release of Next Version
- www.jpl.nasa.gov/airs